

## PATENT ABSTRACTS OF JAPAN

(11)Publication number : 09-239988

(43)Date of publication of application : 16.09.1997

(51)Int.Cl.

B41J 2/06  
 B41J 2/175  
 B41J 2/18  
 B41J 2/185  
 B41J 2/205

(21)Application number : 08-046127

(71)Applicant : TOSHIBA CORP

(22)Date of filing : 04.03.1996

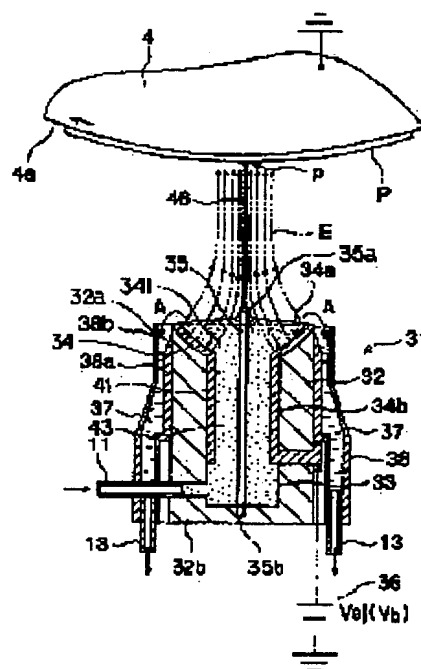
(72)Inventor : YOSHIDA SHIGETO  
 KIMURA KAZUHISA

## (54) IMAGE FORMING APPARATUS

## (57)Abstract:

**PROBLEM TO BE SOLVED:** To provide an image forming apparatus capable of performing stable recording at a high speed and capable of forming a high density image of good quality.

**SOLUTION:** An ink jet printer has the recording head 10 arranged just under a platen roller 4 as an opposed electrode so as to be separated by a predetermined distance and a recording 10 is equipped with a recording unit 31 for flying ink droplets to the recording paper P fed along the platen roller 4. The recording unit 31 is equipped with an emitting electrode 34 having an ink receiving part 34a going toward the recording paper P, an ink passage 33 supplying ink to the ink receiving part 34a from below and an ink guide 35 provided so as to provide to the center of a meniscus. The ink receiving part 34a is formed into a shape concentrating an electric field E to the vicinity of the leading end 35a of the ink guide 35 when voltage is applied to the emitting electrode 34.



## LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision]

of rejection]

[Date of requesting appeal against examiner's  
decision of rejection]

[Date of extinction of right]

Copyright (C); 1998,2003 Japan Patent Office

## \* NOTICES \*

Japan Patent Office is not responsible for any damages caused by the use of this translation.

1.This document has been translated by computer. So the translation may not reflect the original precisely.

2.\*\*\*\* shows the word which can not be translated.

3.In the drawings, any words are not translated.

---

CLAIMS

---

## [Claim(s)]

[Claim 1] The ink receptacle section which has the convex concave surface prepared by the record medium arranged at the abbreviation horizontal carrying out predetermined distance alienation caudad, An ink supply means to supply the ink which distributes the electrified coloring-material particle in an insulating liquid, and changes to the above-mentioned ink receptacle section, The guide member which guides the ink supplied to the ink receptacle section by the above-mentioned ink supply means to a predetermined regurgitation location, A condensation means to make a coloring-material particle condense within the ink which formed the 1st electric field concentrated near [ a regurgitation location ] the above, and was guided in the above-mentioned guide member, Image formation equipment characterized by having a flight means to turn to the above-mentioned record medium the coloring-material particle which formed the 2nd larger electric field than the 1st electric field of the above concentrated on the predetermined point on the above-mentioned record medium recording [-ed ], and was condensed with the above-mentioned condensation means, and to make it fly.

[Claim 2] The discharge electrode which carried out predetermined distance alienation, has been arranged at the inferior-surface-of-tongue side of the record medium conveyed with a conveyance means to convey a record medium at an abbreviation horizontal, and the above-mentioned conveyance means, countered the above-mentioned record medium and formed the ink receptacle section of the shape of a convex concave surface which has opening in the center of abbreviation, An ink supply means to form the ink meniscus which supplies the ink which distributes the electrified coloring-material particle in an insulating liquid, and changes from the lower part of the above-mentioned discharge electrode to the above-mentioned ink receptacle section through the above-mentioned opening, and faces to the above-mentioned record medium, The guide member which has the point projected from the center of abbreviation of the above-mentioned ink meniscus, and guides the above-mentioned ink to a predetermined regurgitation location higher than the above-mentioned ink meniscus by this point, A condensation means to make a coloring-material particle condense within the ink which impressed the 1st bias voltage to the above-mentioned discharge electrode, formed the 1st electric field between the above-mentioned record media, and was guided in the above-mentioned guide member, Impress the 2nd bias voltage higher than the 1st bias voltage of the above to the above-mentioned discharge electrode, and the 2nd larger electric field than the 1st electric field of the above are formed between the above-mentioned record media. It has a flight means to turn to the above-mentioned record medium the ink containing the coloring-material particle condensed with the above-mentioned condensation means, and to make it fly. The above-mentioned ink receptacle section When the 1st bias voltage of the above is impressed to the above-mentioned discharge electrode, the 1st electric field of the above concentrate near the point of the above-mentioned guide member. And image formation equipment characterized by having a configuration which the 2nd electric field of the above concentrate to the predetermined point on the above-mentioned record medium recording [-ed ] when the 2nd bias voltage of the above is impressed to the above-mentioned discharge electrode.

[Claim 3] The above-mentioned discharge electrode has the extension section caudad prolonged

through the above-mentioned opening. The above-mentioned ink supply means It is open for free passage to the above-mentioned opening through the above-mentioned extension section, and has the ink passage which extended in the direction of an abbreviation vertical. Near the lower limit of the above-mentioned ink passage Image formation equipment according to claim 2 characterized by preparing the condensation electrode for forming the 3rd electric field for raising the coloring-material particle in ink in the above-mentioned ink passage between the above-mentioned extension sections.

[Claim 4] Image formation equipment according to claim 3 characterized by being higher than the 1st bias voltage of the above to the above-mentioned condensation electrode, and impressing a condensation electrical potential difference lower than the 2nd bias voltage of the above to it.

[Claim 5] Image formation equipment according to claim 3 characterized by making coating which consists of an insulating material on one [ at least ] field of the field which the field and the above-mentioned condensation electrode which the above-mentioned discharge electrode exposes to the above-mentioned ink expose to the above-mentioned ink.

[Claim 6] The above-mentioned coating is image formation equipment according to claim 5 characterized by being formed with the ingredient which has the wettability of ink equivalent to the above-mentioned guide member and the above-mentioned ink passage.

[Claim 7] The discharge electrode which carried out predetermined distance alienation, has been arranged by the inferior-surface-of-tongue side of the record medium conveyed with a conveyance means to convey a record medium at an abbreviation horizontal, and the above-mentioned conveyance means, countered the above-mentioned record medium and formed the ink receptacle section of the shape of a convex concave surface which has opening in the center of abbreviation, An ink supply means to form the ink meniscus which supplies the ink which distributes the electrified coloring-material particle in an insulating liquid, and changes from the lower part of the above-mentioned discharge electrode to the above-mentioned ink receptacle section through the above-mentioned opening, and faces to the above-mentioned record medium, the point projected from the center of abbreviation of the above-mentioned ink meniscus -- having -- the above-mentioned point of the above-mentioned ink depended for getting wet -- creeping up -- with the guide member which guides the above-mentioned ink to a regurgitation location higher than the above-mentioned ink meniscus A condensation means to make a coloring-material particle condense within the ink which impressed the 1st bias voltage to the above-mentioned discharge electrode, formed the 1st electric field between the above-mentioned record media, and was guided in the above-mentioned guide member, Impress the 2nd bias voltage higher than the 1st bias voltage of the above to the above-mentioned discharge electrode, and the 2nd larger electric field than the 1st electric field are formed between the above-mentioned record media. A flight means to turn to the above-mentioned record medium the ink containing the coloring-material particle condensed with the above-mentioned condensation means, and to make it fly, An ink recovery means to have the ink recovery way which collects the surplus ink with which it is surplus ink which the above-mentioned ink receptacle section was supplied and did not fly with the above-mentioned ink supply means, and overflowed from the edge of the above-mentioned ink receptacle section, The surplus ink collected with the above-mentioned ink recovery means is received, ink concentration is adjusted, and it has an ink circulation means to circulate to the above-mentioned ink supply means. The above-mentioned ink receptacle section When the 1st bias voltage of the above is impressed to the above-mentioned discharge electrode, the 1st electric field of the above concentrate near the point of the above-mentioned guide member. And image formation equipment characterized by having a configuration which the 2nd electric field of the above concentrate to the predetermined point on the above-mentioned record medium recording [-ed ] when the 2nd bias voltage of the above is impressed to the above-mentioned discharge electrode.

[Claim 8] The above-mentioned discharge electrode has the extension section caudad prolonged through the above-mentioned opening. The above-mentioned ink supply means It is open for free passage to the above-mentioned opening through the above-mentioned extension section, and has the ink passage which extended in the direction of an abbreviation vertical. Near the lower

limit of the above-mentioned ink passage Image formation equipment according to claim 7 characterized by preparing the condensation electrode for forming the 3rd electric field for raising the coloring-material particle in ink in the above-mentioned ink passage between the above-mentioned extension sections.

[Claim 9] Image formation equipment according to claim 8 characterized by making coating which consists of an insulating material on one [ at least ] field of the field which the field and the above-mentioned condensation electrode which the above-mentioned discharge electrode exposes to the above-mentioned ink expose to the above-mentioned ink.

[Claim 10] The above-mentioned coating is image formation equipment according to claim 9 characterized by being formed with the ingredient which has the wettability of ink equivalent to the above-mentioned guide member, the above-mentioned ink passage, and the above-mentioned ink recovery way.

---

[Translation done.]

## \* NOTICES \*

Japan Patent Office is not responsible for any damages caused by the use of this translation.

1.This document has been translated by computer. So the translation may not reflect the original precisely.

2.\*\*\*\* shows the word which can not be translated.

3.In the drawings, any words are not translated.

---

DETAILED DESCRIPTION

---

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention makes electrostatic force act on the ink which makes an insulating liquid carrier come to distribute a coloring-material particle, and relates to the image formation equipment which an ink droplet is made to fly on a record medium, and forms an image.

[0002]

[Description of the Prior Art] In recent years, in the personal printer field, the ink jet printer which used the ink jet recording method has spread widely. However, in the conventional ink jet printer, since color nature ink was used, there were problems, like the shelf life and lightfastness of an image are bad.

[0003] On the other hand, use of a pigment particle is enabled as a coloring material, and the image formation equipment which solved the above-mentioned trouble of color nature ink is already indicated by WO 93/No. 1186 official report. This equipment possesses a conductive ink supply tube, and an electrical potential difference is given between an ink supply tube and the counterelectrode which counters at this tip. And the ink containing the pigment particle (an electrification toner is called below) charged to the potential and like-pole nature of an ink supply tube is supplied to an ink supply tube.

[0004] The electrification toner in ink is the regurgitation point near the tip of an ink supply tube, receives an electrostatic suction force from a counterelectrode, and forms a semicircle ball-like ink meniscus. However, a toner cannot fly from an ink meniscus with the surface tension of the solvent of ink, but it stops at the tip of an ink meniscus. Thus, many toners serve as an assembly and an aggregate at the tip of an ink meniscus. If the electrical potential difference between an ink supply tube and a counterelectrode is raised further, rather than the surface tension of the solvent of ink, an electrostatic suction force will excel and a toner aggregate will fly from an ink meniscus.

[0005] With the image formation equipment based on an above-mentioned flight principle, since there is no nozzle which determines flight globule size like the conventional ink jet record, a pigment particle can be used. For this reason, problems, such as the shelf life of an image which was the trouble of the conventional ink jet printer, and lightfastness, are solved.

[0006]

[Problem(s) to be Solved by the Invention] However, the image formation equipment which uses the liquid ink containing the above-mentioned conventional toner also has the following troubles. That is, in conventional image formation equipment, in order to collect the toners of sufficient amount required for flight at the tip of the ink meniscus formed in the regurgitation point of an ink supply tube, much time amount is needed. For this reason, there is a problem which cannot make ink fly on a high regurgitation frequency. Moreover, if the regurgitation frequency of ink is raised, condensing [ of the toner in the tip of an ink meniscus ] will become inadequate, and the toner concentration in the ink in which it flies will fall. There is a problem which it becomes impossible to attain desired image concentration, and cannot form a good image by this.

[0007] Furthermore, in conventional image formation equipment, in case a toner aggregate flies

from the ink meniscus formed in the regurgitation point of an ink supply tube, vibration [ \*\*\*\* / un- ] is produced in an ink meniscus, and there is a problem from which the flight direction of ink and the impact area of ink become unstable.

[0008] This invention was made in view of the above point, a high speed and the stable record are possible for that purpose, and it is to offer the image formation equipment which can form a good image by high concentration.

[0009]

[Means for Solving the Problem] In order to attain the above-mentioned purpose, the image formation equipment concerning this invention The ink receptacle section which has the convex concave surface prepared by the record medium arranged at the abbreviation horizontal carrying out predetermined distance alienation caudad, An ink supply means to supply the ink which distributes the electrified coloring-material particle in an insulating liquid, and changes to the above-mentioned ink receptacle section, The guide member which guides the ink supplied to the ink receptacle section by the above-mentioned ink supply means to a predetermined regurgitation location, A condensation means to make a coloring-material particle condense within the ink which formed the 1st electric field concentrated near [ a regurgitation location ] the above, and was guided in the above-mentioned guide member, The 2nd larger electric field than the 1st electric field of the above concentrated on the predetermined point on the above-mentioned record medium recording [-ed ] were formed, and it has a flight means to turn to the above-mentioned record medium the coloring-material particle condensed with the above-mentioned condensation means, and to make it fly.

[0010] Moreover, a conveyance means by which the image formation equipment of this invention conveys a record medium at an abbreviation horizontal, The discharge electrode which carried out predetermined distance alienation, has been arranged at the inferior-surface-of-tongue side of the record medium conveyed with the above-mentioned conveyance means, countered the above-mentioned record medium and formed the ink receptacle section of the shape of a convex concave surface which has opening in the center of abbreviation, An ink supply means to form the ink meniscus which supplies the ink which distributes the electrified coloring-material particle in an insulating liquid, and changes from the lower part of the above-mentioned discharge electrode to the above-mentioned ink receptacle section through the above-mentioned opening, and faces to the above-mentioned record medium, The guide member which has the point projected from the center of abbreviation of the above-mentioned ink meniscus, and guides the above-mentioned ink to a predetermined regurgitation location higher than the above-mentioned ink meniscus by this point, A condensation means to make a coloring-material particle condense within the ink which impressed the 1st bias voltage to the above-mentioned discharge electrode, formed the 1st electric field between the above-mentioned record media, and was guided in the above-mentioned guide member, Impress the 2nd bias voltage higher than the 1st bias voltage of the above to the above-mentioned discharge electrode, and the 2nd larger electric field than the 1st electric field of the above are formed between the above-mentioned record media. It has a flight means to turn to the above-mentioned record medium the ink containing the coloring-material particle condensed with the above-mentioned condensation means, and to make it fly. The above-mentioned ink receptacle section When the 1st electric field of the above concentrate near the point of the above-mentioned guide member when the 1st bias voltage of the above is impressed to the above-mentioned discharge electrode, and the 2nd bias voltage of the above is impressed to the above-mentioned discharge electrode, it has a configuration which the 2nd electric field of the above concentrate to the predetermined point on the above-mentioned record medium recording [-ed ].

[0011] According to the above-mentioned image formation equipment, the ink receptacle circles by which the ink which distributes the electrified coloring-material particle in an insulating liquid, and changes was formed in the discharge electrode are supplied, and an ink meniscus is formed here. While turning ink to a record medium and guiding it to the abbreviation mid gear of an ink meniscus, the guide member which specifies the regurgitation location of ink is prepared.

[0012] If the 1st bias voltage is impressed to a discharge electrode, it will condense near the top-most vertices (nearest point of a record medium) of the ink in which the 1st electric field

which pass near the point of a guide member were formed, and the coloring-material particle in ink was guided by the guide member. And if the 2nd bias voltage higher than the 1st bias voltage is impressed to a discharge electrode, the ink containing the coloring-material particle which the 2nd electric field which tend toward the predetermined point of a record medium recording [-ed] were formed, and condensed will fly towards a record medium. That is, the ink receptacle section has a configuration which the 1st electric field concentrate near the point of a guide member, and the 2nd electric field concentrate on the point recording [-ed].

[0013] Therefore, according to this image formation equipment, since coloring-material particles can be collected efficiently and quickly to the regurgitation location of ink and the concentration of sufficient coloring-material particle can be attained in a short time, a record frequency can be raised. Moreover, by preparing a guide member in the abbreviation mid gear of an ink meniscus, the flight direction and impact area of ink can be stabilized, and a good image can be formed.

[0014] The above-mentioned discharge electrode has the extension section caudad prolonged through opening of the ink receptacle section. Moreover, the above-mentioned ink supply means It is open for free passage to the above-mentioned opening through the above-mentioned extension section, and has the ink passage which extended in the direction of an abbreviation vertical, and the condensation electrode for forming the 3rd electric field for raising the coloring-material particle in ink in the above-mentioned ink passage between the above-mentioned extension sections near the lower limit of the above-mentioned ink passage is prepared.

[0015] Thus, by preparing a condensation electrode under the discharge electrode, the toner particle which piled up in the bottom of ink passage can be pushed up near the ink meniscus, and the concentration of the coloring-material particle of ink [ / near the ink meniscus ] can be raised.

[0016] Moreover, coating which consists of an insulating material is made on one [ at least ] field of the field which the field and the above-mentioned condensation electrode which the above-mentioned discharge electrode exposes to the above-mentioned ink expose to the above-mentioned ink.

[0017] Thus, by performing coating which consists of an insulating material on the front face exposed to the ink of a discharge electrode and/, or a condensation electrode, impregnation of the charge to the carrier liquid in ink can be prevented, and flight [ \*\*\*\* / the carrier liquid by electrification of carrier liquid / un- ] can be reduced. Thereby, a good image can be formed by high concentration. Moreover, by performing coating, adhesion of a coloring-material particle in each electrode can be prevented, and the blinding of the ink in ink passage can be reduced.

[0018] Moreover, the above-mentioned coating is formed with the ingredient which has the wettability of ink equivalent to the above-mentioned guide member and the above-mentioned ink passage. Thereby, without confusing the flow of ink by the wettability difference in ink, the flow of ink becomes smooth and producing vibration [ \*\*\*\* / un- ] is prevented.

[0019] Moreover, a conveyance means by which the image formation equipment of this invention conveys a record medium at an abbreviation horizontal, The discharge electrode which carried out predetermined distance alienation, has been arranged by the inferior-surface-of-tongue side of the record medium conveyed with the above-mentioned conveyance means, countered the above-mentioned record medium and formed the ink receptacle section of the shape of a convex concave surface which has opening in the center of abbreviation, An ink supply means to form the ink meniscus which supplies the ink which distributes the electrified coloring-material particle in an insulating liquid, and changes from the lower part of the above-mentioned discharge electrode to the above-mentioned ink receptacle section through the above-mentioned opening, and faces to the above-mentioned record medium, the point projected from the center of abbreviation of the above-mentioned ink meniscus -- having -- the above-mentioned point of the above-mentioned ink depended for getting wet -- creeping up -- with the guide member which guides the above-mentioned ink to a regurgitation location higher than the above-mentioned ink meniscus A condensation means to make a coloring-material particle condense within the ink which impressed the 1st bias voltage to the above-mentioned discharge electrode, formed the 1st electric field between the above-mentioned record media, and was guided in the above-mentioned guide member, Impress the 2nd bias voltage higher than the 1st



bias voltage of the above to the above-mentioned discharge electrode, and the 2nd larger electric field than the 1st electric field are formed between the above-mentioned record media. A flight means to turn to the above-mentioned record medium the ink containing the coloring-material particle condensed with the above-mentioned condensation means, and to make it fly, An ink recovery means to have the ink recovery way which collects the surplus ink with which it is surplus ink which the above-mentioned ink receptacle section was supplied and did not fly with the above-mentioned ink supply means, and overflowed from the edge of the above-mentioned ink receptacle section, The surplus ink collected with the above-mentioned ink recovery means is received, ink concentration is adjusted, and it has an ink circulation means to circulate to the above-mentioned ink supply means. The above-mentioned ink receptacle section When the 1st electric field of the above concentrate near the point of the above-mentioned guide member when the 1st bias voltage of the above is impressed to the above-mentioned discharge electrode, and the 2nd bias voltage of the above is impressed to the above-mentioned discharge electrode, it has a configuration which the 2nd electric field of the above concentrate to the predetermined point on the above-mentioned record medium recording [-ed ].

[0020] According to the above-mentioned image formation equipment, the surplus ink with which it overflowed from the ink receptacle section is recovered by the ink recovery means, and it circulates through it to an ink supply means with an ink circulation means. The above-mentioned discharge electrode has the extension section caudad prolonged through the above-mentioned opening. Moreover, the above-mentioned ink supply means It is open for free passage to the above-mentioned opening through the above-mentioned extension section, and has the ink passage which extended in the direction of an abbreviation vertical, and the condensation electrode for forming the 3rd electric field for raising the coloring-material particle in ink in the above-mentioned ink passage between the above-mentioned extension sections near the lower limit of the above-mentioned ink passage is prepared.

[0021] Moreover, coating which consists of an insulating material is made on one [ at least ] field of the field which the field and the above-mentioned condensation electrode which the above-mentioned discharge electrode exposes to the above-mentioned ink expose to the above-mentioned ink. Furthermore, the above-mentioned coating is formed with the ingredient which has the wettability of ink equivalent to the above-mentioned guide member, the above-mentioned ink passage, and the above-mentioned ink recovery way.

[0022]

[Embodiment of the Invention] Hereafter, the gestalt of implementation of this invention is explained to a detail, referring to a drawing. As shown in drawing 1 , the ink jet printer 1 as image formation equipment of this invention is equipped with housing 2. While holding the recording paper P as a record medium, the platen roller 4 of the cylindrical shape for conveying in the predetermined direction is arranged in the predetermined location in housing 2. It consists of a conductive ingredient, and it is grounded, or predetermined potential is given if needed, and a platen roller 4 acts as a counterelectrode.

[0023] Opposite arrangement of the recording head 10 later mentioned for flying ink on the recording paper P conveyed by the platen roller 4, and forming an image in the location which carried out predetermined distance alienation in the lower part of a platen roller 4 is carried out. That is, a recording head 10 makes ink fly to the abbreviation vertical upper part, and forms an image in the recording paper P.

[0024] It is the lower part of a recording head 10, and the ink hold section 12 which held ink is arranged in the pars basilaris ossis occipitalis of housing 2. Moreover, the pump 14 for pumping up the ink in the ink hold section 12 to a recording head 10 is arranged in the left-hand side pars basilaris ossis occipitalis of housing 2 through the ink supply pipe 11. A pump 14 supplies ink to a recording head 10 by a predetermined ink supply pressure and a predetermined, predetermined flow rate.

[0025] The ink recovery tubing 13 for collecting the surplus ink which was not used having supplied the recording head 10 to the ink hold section 12 is connected to the recording head 10. Moreover, the aspirator 16 is connected to the ink hold section 12. An aspirator 16 makes an upper field produce negative pressure from the ink side in the ink hold section 12. And this

negative pressure recovers surplus ink to the ink hold section 12 through the ink recovery tubing 13.

[0026] Here, the component of the ink mentioned above is explained. That is, ink distributes the electrified toner as a coloring-material particle in the carrier liquid as an insulating liquid, and is constituted. Carrier liquid is a dispersion medium which consists for example, of an isoparaffin system solvent (for example, Isopar G, H, and L (trade name) whose direct-current electric resistance at the time of impressing the electrical potential difference of 100 volts is more than a  $10^{12}$ – $10^{13}$ -ohm centimeter), and a toner is a resin particle which has the particle diameter of about 0.01–5 micrometers, is charged in predetermined potential (here forward potential), and has a coloring component at least. Although this ink is fundamentally the same as the liquid development agent used with electrophotography etc., what has electric resistance higher than a liquid development agent is demanded.

[0027] With a pump 14, the above-mentioned ink is pumped up from the ink hold section 12, and is supplied to a recording head 10 through the ink supply pipe 11. The surplus ink in which a recording head 10 did not fly is attracted through the ink recovery tubing 13 with the negative pressure by the aspirator 16, and is collected to the ink hold section 12. Thus, it is used for the inside of a recording head 10 by ink, circulating.

[0028] The toner concentration of the ink collected by the ink hold section 12 is falling by image formation (flight of a toner), and needs to adjust the toner concentration of ink to a suitable value for a reuse. For this reason, the detector 18 which detects the toner concentration of the ink which flows the inside of a pipe in the middle of the by-path pipe 15 between the ink hold section 12 and a pump 14 and the ink supply pipe 11 is formed. Moreover, the ink supply container 17 for supplying the high concentration ink which adjusted toner concentration to the predetermined value beforehand to the ink hold section 12 is arranged above the ink hold section 12. The ink concentration in the ink hold section 12 is held to a predetermined value by carrying out a deer and carrying out specified quantity supply of the high concentration ink according to the detection result of a detector 18.

[0029] Moreover, since specific gravity is lower than carrier liquid, the toner in ink needs to stir and supply the ink in the ink hold section 12. For this reason, in the ink hold section 12, the stirring equipment 19 for stirring the ink held in the ink hold section 12 is formed. And the ink in the ink hold section 12 is pumped up with a pump 14, after it always stirred and the toner has been distributed by homogeneity within ink with stirring equipment 19, and it is supplied to a recording head 10.

[0030] The recording paper hold cassette 21 (a sheet paper cassette 21 is only called hereafter) which held two or more sheets of recording papers P in the state of the laminating is arranged in the location which adjoined the drawing Nakamigi side of the above-mentioned platen roller 4. The feed roller 24 for taking out the recording paper P held in the sheet paper cassette 21 from the thing of the maximum upper limit near the edge by the side of the platen roller 4 of a sheet paper cassette 21 is formed rotatable. Moreover, in the sheet paper cassette 21, the device (not shown) for turning and making the conveyance direction tip of the recording paper P the feed roller 24 is established.

[0031] Between the tip of a sheet paper cassette 21, and the platen roller 4, the resist roller 26 of a pair conveyed once it turns to a platen roller 4 the detail paper P taken out from the sheet paper cassette 21 and it carries out ready grade with the feed roller 24 is formed.

[0032] The paper output tray 28 which delivers paper to the recording paper P which passed the recording head 10 and formed the image is formed in the downstream of a platen roller 4. Moreover, between the platen roller 4 and the paper output tray 28, the delivery roller 27 of a pair which pinches the recording paper P conveyed through the platen roller 4, and is conveyed towards a paper output tray 28 is formed. In addition, two or more conveyance guides 25 and guide idlers 29 are prepared in the conveyance on the street of the recording paper P which goes to a paper output tray 28 from the sheet paper cassette 21 mentioned above.

[0033] A deer is carried out, with the resist roller 26, pinching conveyance is carried out and the detail paper P taken out from the sheet paper cassette 21 by rotation of the feed roller 24 is supplied between a platen roller 4 and a recording head 10. Under the present circumstances,

the recording paper P is conveyed where the peripheral face of a platen roller 4 is contacted, and an abbreviation horizontal is accomplished in the location which counters a recording head 10. With the delivery roller 27, pinching conveyance is carried out and the recording paper P conveyed along with the peripheral face of a platen roller 4 is discharged on a paper output tray 28. In addition, the above-mentioned feed roller 24, the resist roller 26, a platen roller 4, and the delivery roller 27 act as a conveyance means of this invention.

[0034] It is the upper right side of housing 2, and the controller 20 for carrying out drive control of each device of an ink jet printer 1 is formed above the sheet paper cassette 21. A controller 20 generates the picture signal for driving alternatively each discharge electrode (it mentioning later) of a recording head 10.

[0035] Next, the recording head 10 concerning the gestalt of the 1st operation is explained to a detail. The recording head 10 has the record unit 31 (refer to drawing 2 ) for making an ink droplet fly towards the recording paper P conveyed along with a platen roller 4. Only the number according to record resolution is put in order and formed in the direction which crosses the conveyance direction of the recording paper P, and the record unit 31 is alternatively driven according to the picture signal generated by the controller 20. In addition, it has illustrated only on behalf of one record unit 31 here.

[0036] As shown in drawing 3 , the record unit 31 has the supporter material 32 of an approximate circle pilaster. The supporter material 32 has upper limit 32a arranged in the location which carried out predetermined distance alienation at the vertical lower part from the point p (it considers as the point p recording [-ed ] hereafter) that the ink droplet which is the lowest point on peripheral face 4a of a platen roller 4 and which flies from the record unit 31 reaches, and the medial axis is prolonged in the direction of a vertical, and it is prepared. The ink passage 33 which extended [ to / from upper limit 32a to which the supporter material 32 countered the platen roller 4 / near the lower limit 32b of the supporter material 32 ] in the core of the supporter material 32 is formed in the supporter material 32 and the same axle.

[0037] The ink guide 35 of the shape of a rod formed in the ink passage 33 of the supporter material 32 by the insulating material which acts as a guide member which guides ink is arranged in the center of the ink passage 33 by the same axle. End face section 35b of the ink guide 35 is laid under the lower limit 32b of the supporter material 32, and it is made a taper that the regurgitation point of ink should be formed, and from upper limit 32a of the supporter material 32, point 35a of the ink guide 35 is projected in the platen roller 4 direction up, and is prepared in it.

[0038] Moreover, near the pars basilaris ossis occipitalis of the ink passage 33, the ink supply pipe 11 is connected from the outside of the record unit 31. In addition, these ink supply pipes 11 and the ink passage 33 act as an ink supply means of this invention with the ink hold section 12 and the pump 14 which were mentioned above.

[0039] Near the upper limit 32a of the supporter material 32, the discharge electrode 34 which covered this upper limit 32a and was caudad prolonged to the middle of the ink passage 33 is formed. Partial 34a to which the discharge electrode 34 covered upper limit 32a of the supporter material 32 acts as the ink receptacle section of this invention, and partial 34b caudad prolonged along the ink passage 33 acts as the extension section. Ink receptacle section 34a forms the convex concave surface so that it may receive the ink which went up the inside of the ink passage 33. In addition, the discharge electrode 34 is formed in the ink guide 35 mentioned above in the state of non-contact.

[0040] When the configuration of ink receptacle section 34a forms electric field E between a discharge electrode 34 and a platen roller 4, the line of electric force is determined that it will concentrate on the point p on peripheral face 4a of a platen roller 4 recording [-ed ] [ near the point 35a of the ink guide 35 ]. In addition, with the gestalt of this operation, the configuration of this ink receptacle section 34a accomplishes the concave surface of an abbreviation semi-sphere, and the opening 341 which was open for free passage to the ink passage 33 is formed in the center of ink receptacle section 34a. Moreover, it connects with the discharge electrode 34 through IC which the power source 36 (a condensation means or flight means) for impressing a predetermined electrical potential difference alternatively according to the picture signal from a controller 20 does not illustrate.

[0041] The guide member 38 of the double structure of a cylindrical shape is formed in the outside of the supporter material 32 at the supporter material 32 and the same axle. The guide member 38 forms the ink recovery way 37 for collecting the surplus ink with which it overflowed from the edge of the above-mentioned ink receptacle section 34a formed in upper limit 32a of the supporter material 32 while holding the supporter material 32 in a predetermined location. The guide member 38 consisted of inside partial 38a and lateral part 38b which were mutually prepared in the same axle, and has specified the ink recovery way 37 among each [ these ] parts 38a and 38b. Converging the tip of inside partial 38a toward the edge of ink receptacle section 34a, the tip of lateral part 38b has extended to the height of the edge of ink receptacle section 34a at least. Moreover, the ink recovery tubing 13 mentioned above is connected to the lower limit of the ink recovery way 37. In addition, these ink recovery ways 37 and the ink recovery tubing 13 act as an ink recovery means of this invention with the aspirator 16 mentioned above.

[0042] The ink which carried out the deer and was supplied in the record unit 31 through the ink supply pipe 11 goes up the inside of the ink passage 33 with a predetermined ink supply pressure, and flows into ink receptacle section 34a through opening of ink receptacle section 34a. The ink supplied to ink receptacle section 34a forms the ink meniscus according to \*\*\*\* of ink supply-pressure and ink receptacle section 34a, the wettability of the ink guide 35, and the surface tension of ink. Under the present circumstances, point 35a of the ink guide 35 is projected more nearly up than an ink meniscus.

[0043] The ink with which it overflowed in the direction of drawing Nakaya mark A from the edge of ink receptacle section 34a with supply of ink flows in the ink recovery way 37 from the upper limit of the guide member 38 (inside partial 38a), flows caudad along the ink recovery way 37, and is collected through the ink recovery tubing 13 to the ink hold section 12.

[0044] In addition, the supporter material 32 and the ink guide 35 which were mentioned above, and the guide member 38 are constituted by each with an insulating material, and the ingredient with the good wettability of ink is used. Moreover, the supporter material 32, the ink guide 35, and the guide member 38 are constituted by the ingredient which has the wettability of equivalent ink.

[0045] Next, in the record unit 31 constituted as mentioned above, the ink droplet which impresses a predetermined electrical potential difference to a discharge electrode 34, and contains the toner particle in ink is explained using drawing 4 about the flight actuation in the case of turning to the recording paper P and making it fly.

[0046] If ink is circulated in the record unit 31 as mentioned above, the ink meniscus 42 will be formed in ink receptacle section 34a in the ink 41 supplied to ink receptacle section 34a. Under the present circumstances, point 35a of the ink guide 35 is projected more nearly up than the front face of the ink meniscus 42. In this condition, if bias voltage  $V_b$  is impressed according to a power source 36 at a discharge electrode 34 (the 1st bias voltage), electric field (the 1st electric field) as shown by the drawing Nakaya mark E between a discharge electrode 34 and a platen roller 4 will be formed. In this case, line of electric force is concentrated on the point p on peripheral face 4a of a platen roller 4 recording [-ed] [ near the point 35a of the ink guide 35 ].

[0047] With the surface tension of this electric field E and ink 41, the toner particles 43 in ink 41 are collected near the point 35a of the ink guide 35. Thus, if the toner particles 43 are collected near the point 35a of the ink guide 35, the strong electrostatic force by electric field E acts on the collected toner aggregate 44, the ink which met the ink guide 35 will crawl, a riser will be produced, and the wrap Taylor cone 45 will be formed in point 35a of the ink guide 35. Therefore, the toner aggregate 44 near the top-most vertices (regurgitation location) of the Taylor cone 45 condenses. Bias voltage  $V_b$  is set up so that the ink droplet 46 which contains the toner aggregate 44 according to the electrostatic force which is alike and is generated by electric field E in this case may not fly.

[0048] Thus, where the Taylor cone 45 is formed in point 35a of the ink guide 35, if the record electrical potential difference  $V_{ej}$  (the 2nd bias voltage) higher than bias voltage  $V_b$  is impressed to a discharge electrode 34 with predetermined pulse width according to a power source 36, electric field (the 2nd electric field) stronger than the electric field E at the time of bias voltage  $V_b$  impression will be formed. And the electrostatic force which acts on the toner aggregate 44

by this electric field overcomes the surface tension of ink 41, and the ink droplet 46 containing the toner aggregate 44 flies towards the point p on a platen roller 4 recording [-ed] from the tip of the Taylor cone 45.

[0049] If an ink droplet 46 flies from the tip of the Taylor cone 45, the ink by point 35a of the ink guide 35 prepared in the center of the ink meniscus 42 will creep up, the ink which ran short by flight of an ink droplet 46 will be compensated according to an operation, and the Taylor cone 45 will be restored in an instant.

[0050] as mentioned above, according to the record unit 31 concerning the gestalt of this operation, the ink guide 35 be formed in the center of the ink passage 33 formed in the record unit 31, and the concave surface configuration of ink receptacle section 34a be set up so that the sense (the direction of line of electric force) of the electric field E form between a discharge electrode 34 and a platen roller 4 may concentrate on the point p on a platen roller 4 record [-ed] [near the point 35a of the ink guide 35]. Therefore, when electric field E are formed between a discharge electrode 34 and a platen roller 4, the toner particle in ink can be efficiently brought together in a high speed near the point 35a of the ink guide 35. By this, the toner particle of a complement can be condensed to flight in an instant, the toner concentration in ink can fully be raised, and the good image which does not have a blot at high concentration can be formed. Moreover, since a toner particle can be condensed in an instant, the regurgitation frequency of ink can be raised.

[0051] Moreover, the flight direction and impact location of ink can be stabilized by forming the ink guide 35 in the abbreviation mid gear of the ink passage 33, and making point 35a of the ink guide 35 project from the ink meniscus 42. that is, the ink which met the ink guide 35 -- creeping up -- since the Taylor cone 45 is formed in point 35a of the ink guide 35, even if it is the case where it has distortion of some in an ink receptacle section 34a concave surface configuration, the regurgitation location of ink can be stabilized, and the flight direction and impact location of ink can be stabilized.

[0052] next, the gestalt of the 2nd operation which added the condensation electrode 52 to the above-mentioned record unit 31 is started -- it attaches record unit 51 and explains with reference to drawing 5. In addition, the same sign is attached about the same configuration as the record unit 31 here, and the explanation is omitted.

[0053] The record unit 51 equips the pars basilaris ossis occipitalis of the ink passage 33 with the condensation electrode 52. The condensation electrode 52 is estranged in the state of a discharge electrode 34 and non-contact, and is prepared in the vertical lower part to the discharge electrode 34. Moreover, it is higher than the bias voltage Vb impressed to a discharge electrode 34 to the condensation electrode 52, and the power source 54 for impressing the condensation electrical potential difference Vep lower than the record electrical potential difference Vej is connected to it.

[0054] If a deer is carried out, bias voltage Vb is impressed to a discharge electrode 34 according to a power source 36 and the condensation electrical potential difference Vep higher than bias voltage Vb is impressed to the condensation electrode 52 according to a power source 54, the electric field (the 3rd electric field) which go to a discharge electrode 34 from the condensation electrode 52 as drawing Nakaya mark E' shows (it goes to the method of drawing Nakagami) will be formed. By this electric-field E', the toner particle 43 which piled up near the pars basilaris ossis occipitalis of the ink passage 33 is raised in the discharge electrode 34 direction, and about 42 ink meniscus toner concentration can be raised more.

[0055] Therefore, if the record unit 51 concerning the gestalt of this operation is used, the toner concentration near about [that the same effectiveness as the record unit 31 concerning the gestalt of the 1st operation mentioned above can be acquired] and the ink meniscus 42 can be raised more, and the condensation effectiveness of a toner particle can be raised more.

[0056] Next, the discharge electrode 34 of the record unit 31 concerning the gestalt of the 1st operation is explained with reference to drawing 6 about the record unit 61 concerning the gestalt of the 3rd operation coated with the insulating material. In addition, the same sign is attached about the same configuration as the record unit 31 here, and the explanation is omitted.

[0057] The record unit 61 has the coating 62 to which a discharge electrode 34 (ink receptacle section 34a and extension section 34b) consists of an insulating material on the front face exposed to the ink passage 33. coating 62 -- Ti N and Si O<sub>2</sub> etc. -- resin, such as a metallic oxide, and polyimide, a polycarbonate, etc. is formed in an about 1-10-micrometer coat, and it changes. [ for example, ] In addition, this coating 62 is formed with the supporter material 32, the ink guide 35, and the ingredient that has the wettability of ink equivalent to the guide member 38.

[0058] Thus, by forming coating 62 on the front face which the discharge electrode 34 exposed, it can prevent that electrification is poured into un-wanting from a discharge electrode 34 to the carrier liquid in ink, and flight of the carrier liquid by electrification of carrier liquid can be prevented. Therefore, if the record unit 61 concerning the gestalt of this operation is used, while being able to acquire the same effectiveness as the record unit 31 concerning the gestalt of the 1st operation mentioned above, flight of carrier liquid can be controlled, toner concentration can be raised, and the good image which does not have a blot at high concentration can be formed.

[0059] Moreover, by forming coating 62 in a discharge electrode 34, toner adhesion on the front face of a discharge electrode 34 can be prevented, and the blinding of the ink in the ink passage 33 can be prevented.

[0060] Next, the case where arranged in the single tier the record unit (here explains on behalf of the recording head 31 concerning the gestalt of the 1st operation) concerning the gestalt of the 1st mentioned above thru/or the 3rd operation, and a recording head 10 is multichannel-ized is explained using drawing 7 thru/or drawing 10.

[0061] When multichannel-izing a recording head 10, a tip is arranged so that the ink flight direction of each record unit 31 may become parallel mutually toward the recording paper P about the record unit 31 constituted as mentioned above, and it arranges so that it may stand in a line in the direction in which the regurgitation location at the tip crosses the conveyance direction of the recording paper P at a single tier (refer to drawing 7). In this case, the number of the record unit 31 can be set as arbitration according to the width of face of the recording paper P.

[0062] Moreover, as shown in drawing 8, by considering as the configuration which arranges the supporter material 32 of the predetermined number in a single tier, and holds these by single guide member 38', the configuration of a recording head can be simplified and components mark can be reduced. Furthermore, as shown in drawing 9, the configuration of a recording head 10 can be simplified more by considering as the configuration which supports two or more discharge electrodes 34 by single supporter material 32', and holds this supporter material 32' by single guide member 38'. Furthermore, as shown in drawing 10, manufacture of a recording head 10 becomes easy by considering as the configuration which divided a discharge electrode 34 and supporter material 32' into two along the direction where two or more discharge electrodes 34 were located in a line. That is, after forming a discharge electrode 34 in each divided supporter material 32', an electrode can be easily manufactured by making each supporter material 32' rival.

[0063] next, the gestalt of implementation of the 4th of this invention is started -- it attaches record unit 71 and explains using drawing 11 and drawing 12. In addition, since the fundamental configuration is the same as the record unit 31 concerning the gestalt of implementation of the above 1st, about the same part as the gestalt of the 1st operation, explanation is omitted using the same sign, and only a different part from the gestalt of the 1st operation is explained.

[0064] The record unit 71 is equipped with the supporter material 72 of an abbreviation square pole form. The supporter material 72 carries out predetermined distance alienation at a vertical lower part from the point p on peripheral face 4a of a platen roller 4 recording [-ed], and is extended and arranged in the direction of a vertical. The ink passage 73 of the cross-section rectangle prolonged [ to / from the center of upper limit where the supporter material 72 countered the platen roller 4 / near the lower limit of the supporter material 72 ] is formed in the core of the supporter material 72.

[0065] In the ink passage 73 of the supporter material 72, the abbreviation rectangle tabular ink guide 75 formed by the insulating material is arranged. The ink guide 75 is formed so that the ink

passage 73 may be equally divided into two perpendicularly in the center, and end face 75b of the ink guide 75 is laid under the lower limit 72b of the supporter material 72. It is made a taper that the regurgitation point of ink should be formed, and point 75a projected in the platen roller 4 direction from upper limit 72a of the supporter material 72 is formed in the upper limit of the ink guide 75. Point 75a is located in the center of the ink passage 73.

[0066] The ink supply pipe 11 which was open for free passage from the outside near the pars basilaris ossis occipitalis of the supporter material 72 is connected to each ink passage 73 carried out 2 \*\*\*\*\* with the ink guide 75, respectively. And ink is supplied to each ink passage 73 through each ink supply pipe 11.

[0067] The discharge electrode 74 which covered this upper limit and was caudad prolonged to the middle of the ink passage 73 is formed in the upper limit of the supporter material 72. The part into which the discharge electrode 74 covered the upper limit of the supporter material 72 forms ink receptacle section 74a of this invention. Ink receptacle section 74a has the flat surface of the pair which inclined caudad toward the ink guide 75 of \*\*\*\*\* from the upper limit edge of the supporter material 72.

[0068] When the configuration of ink receptacle section 74a forms electric field E between a discharge electrode 74 and a platen roller 4, the line of electric force is determined that it will concentrate on the point p on peripheral face 4a of a platen roller 4 recording [-ed] [ near the point 35a of the ink guide 35 ]. In addition, with the gestalt of this operation, the configuration of this ink receptacle section 74a is formed in general in the cross-section V typeface. Moreover, it connects with the discharge electrode 74 through IC which the power source 36 for impressing a predetermined electrical potential difference alternatively according to the picture signal from a controller 20 does not illustrate.

[0069] While holding the supporter material 72 in a predetermined location, the guide member 78 of the double structure of the abbreviation square cartridge in which the ink recovery way 77 for collecting the surplus ink with which it overflowed from the edge of the above-mentioned ink receptacle section 74a formed in the upper limit of the supporter material 72 was formed is formed in the outside of the supporter material 72. The guide member 78 consisted of inside partial 78a and lateral part 78b which were mutually prepared in same axle, and has specified the ink recovery way 77 among each [ these ] parts 78a and 78b. Converging the tip of inside partial 78a toward the edge of ink receptacle section 74a, the tip of lateral part 78b has extended to the height of the edge of ink receptacle section 74a at least. Moreover, the ink recovery tubing 13 is connected to the lower limit of the ink recovery way 77.

[0070] The ink which carried out the deer and was supplied in the record unit 71 through two ink supply pipes 11 goes up the inside of each ink passage 73 with a predetermined ink supply pressure, and flows into ink receptacle section 74a. The ink supplied to ink receptacle section 74a forms the ink meniscus according to an ink supply pressure, the configuration of ink receptacle section 74a, the ink wettability of the ink guide 75, and the surface tension of ink. Under the present circumstances, point 75a of the ink guide 75 is projected more nearly up than an ink meniscus.

[0071] The ink with which it overflowed from the edge of ink receptacle section 74a with supply of ink flows in the ink recovery way 77 from the upper limit of the guide member 78, flows caudad along the ink recovery way 77, and is collected through the ink recovery tubing 13 to the ink hold section 12.

[0072] In addition, the supporter material 72 and the guide member 78 which were mentioned above are constituted by each with an insulating material, and consist of ingredients which have the wettability of good ink equivalent to the ink guide 75.

[0073] Next, in the record unit 71 constituted as mentioned above, the flight actuation in the case of turning to the recording paper P the ink droplet which impresses a predetermined electrical potential difference to a discharge electrode 74, and contains the toner particle in ink, and making it fly is explained.

[0074] Where the ink meniscus 42 is formed in the ink 41 which the record unit 71 was made to circulate through ink, and was supplied to ink receptacle section 74a, if bias voltage Vb is impressed to a discharge electrode 74 according to a power source 36, electric field as shown by



the drawing Nakaya mark E will be formed. In this case, line of electric force is concentrated on the point p on peripheral face 4a of a platen roller 4 recording [-ed] [near the point 75a of the ink guide 75].

[0075] With the surface tension of this electric field E and ink 41, the toner particles 43 in ink 41 are collected near the point 75a of the ink guide 75. Thus, if the toner particles 43 are collected near the point 75a of the ink guide 75, the strong electrostatic force by electric field E acts on the collected toner aggregate 44, the ink which met the ink guide 75 will crawl, a riser will be produced, and the wrap Taylor cone 45 will be formed in point 75a of the ink guide 75. In this case, bias voltage Vb is set up so that the ink droplet 46 which contains the toner aggregate 44 according to the electrostatic force generated by electric field E may not fly.

[0076] Thus, in the condition of having made the Taylor cone 45 form, if the record electrical potential difference Vej higher than bias voltage Vb is impressed to a discharge electrode 74 according to a power source 36, the electrostatic force which acts on the toner aggregate 44 by electric field E will overcome the surface tension of ink 41, and the ink droplet 46 containing the toner aggregate 44 will fly towards the point p on a platen roller 4 recording [-ed] from the tip of the Taylor cone 45.

[0077] If an ink droplet 46 flies from the tip of the Taylor cone 45, the ink by the ink guide 75 prepared in the center of the ink meniscus 42 will creep up, the ink which ran short by flight of an ink droplet 46 will be compensated according to an operation, and the Taylor cone 45 will be restored in an instant.

[0078] According to the above record units 71, the same effectiveness as the record unit 31 concerning the gestalt of the 1st operation mentioned above can be acquired. next, the gestalt of the 5th operation which added the condensation electrode 82 to the above-mentioned record unit 71 is started -- it attaches record unit 81 and explains with reference to drawing 13. In addition, the same sign is attached about the same configuration as the record unit 71 here, and the explanation is omitted.

[0079] The record unit 81 equips the pars basilaris ossis occipitalis of the ink passage 73 with the condensation electrode 82. The condensation electrode 82 is estranged in the state of a discharge electrode 74 and non-contact, and is prepared in the vertical lower part to the discharge electrode 74. Moreover, it is higher than the bias voltage Vb impressed to a discharge electrode 74 to the condensation electrode 82, and the power source 84 for impressing the condensation electrical potential difference Vep lower than the record electrical potential difference Vej is connected to it.

[0080] If a deer is carried out, bias voltage Vb is impressed to a discharge electrode 74 according to a power source 36 and the condensation electrical potential difference Vep higher than bias voltage Vb is impressed to the condensation electrode 82 according to a power source 84, the electric field which go to a discharge electrode 74 from the condensation electrode 82 as drawing Nakaya mark E' shows will be formed. The toner particle 43 which piled up near the pars basilaris ossis occipitalis of the ink passage 73 is raised in the discharge electrode 74 direction by this, and about 42 ink meniscus toner concentration can be raised more.

[0081] Therefore, if the record unit 81 concerning the gestalt of this operation is used, the same effectiveness as the record unit 51 concerning the gestalt of the 2nd operation mentioned above can be acquired. Next, the discharge electrode 74 in the record unit 71 concerning the gestalt of the 4th operation is explained with reference to drawing 14 about the record unit 91 concerning the gestalt of the 6th operation coated with the insulating material. In addition, the same sign is attached about the same configuration as the record unit 71 here, and the explanation is omitted.

[0082] The record unit 91 of the gestalt of this operation has the coating 92 to which a discharge electrode 74 consists of an insulating material on the front face exposed to the ink passage 73. coating 92 -- Ti N and Si O<sub>2</sub> etc. -- resin, such as a metallic oxide, and polyimide, a polycarbonate, etc. is formed in an about 1-10-micrometer coat, and it changes. [for example,]

[0083] Thus, the same effectiveness as the record unit 61 concerning the gestalt of the 3rd operation mentioned above can be acquired by forming coating 92 on the exposure front face of a discharge electrode 74.



[0084] next, the gestalt of implementation of the 7th of this invention is started -- it attaches record unit 101 and explains using drawing 15 . In addition, the record unit 101 concerning the gestalt of this operation has the same configuration, except that the configurations of the record unit 71 concerning the gestalt of the 4th operation mentioned above and the ink receptacle section differ.

[0085] That is, the field where the record unit 101 concerning the gestalt of this operation inclined caudad from the edge of the upper limit of a discharge electrode 74 has curved (forming a curved surface), and the cross-section configuration of the ink receptacle section 102 is formed in the abbreviation U typeface. Thereby, the regurgitation location of ink, i.e., the sense of the electric field formed at the tip of a discharge electrode 74, (the direction of line of electric force) can be centralized on the point p on a platen roller 4 recording [-ed] [ near the point 75a of the ink guide 75 ] like the record unit 71 mentioned above. Therefore, also in the record unit 101 concerning the gestalt of this operation, the same effectiveness as the record unit 71 concerning the gestalt of the 4th operation mentioned above can be acquired.

[0086] Next, the case where arranged in the single tier the record unit 101 concerning the gestalt of the 7th operation mentioned above, and a recording head 10 is multichannel-ized is explained using drawing 16 thru/or drawing 18 . When multichannel-izing a recording head 10, a tip is arranged so that the ink flight direction of each record unit 101 may become parallel mutually toward the recording paper P about the record unit 101 constituted as mentioned above, and it arranges so that it may stand in a line in the direction in which the regurgitation location at the tip crosses the conveyance direction of the recording paper P at a single tier ( drawing 16 ). In this case, the number of the record unit 101 can be set as arbitration according to the width of face of the recording paper P.

[0087] Moreover, as shown in drawing 17 , by considering as the configuration which supports two or more discharge electrodes 74 (ink receptacle section 102) by single supporter material 72', and prepares ink guide 75' which becomes two or more discharge electrodes 74 from a common single member, and holds this supporter material 72' by single guide member 78', the configuration of a recording head can be simplified and components mark can be reduced. Furthermore, as shown in drawing 18 , a recording head can be easily manufactured by considering as the configuration which divided a discharge electrode 74 and supporter material 72' along the direction where two or more discharge electrodes 74 were located in a line. That is, after forming a discharge electrode 74 in each divided supporter material 72', manufacture of an electrode becomes easy by making each supporter material 72' rival on both sides of ink guide 75'.

[0088] In addition, this invention is not limited to the gestalt of operation mentioned above, and is variously deformable within the limits of this invention. For example, the electric field formed not only between the configuration mentioned above but between the platen rollers 4 pass near the point of an ink guide, and the configuration of the ink receptacle section should just be a configuration which is concentrated on the point which it is on a record medium recording [-ed] .

[0089]

[Effect of the Invention] As explained above, since the image formation equipment of this invention has above configurations and operations, a high speed and the stable record are possible for it, and it can form a good image by high concentration.

---

[Translation done.]

## \* NOTICES \*

Japan Patent Office is not responsible for any damages caused by the use of this translation.

1.This document has been translated by computer. So the translation may not reflect the original precisely.

2.\*\*\*\* shows the word which can not be translated.

3.In the drawings, any words are not translated.

---

DESCRIPTION OF DRAWINGS

---

[Brief Description of the Drawings]

[Drawing 1] Drawing 1 is the schematic diagram showing the ink jet printer as image formation equipment of this invention.

[Drawing 2] Drawing 2 is the perspective view showing the record unit which is the important section of the ink jet printer of drawing 1 , and starts the gestalt of implementation of the 1st of this invention.

[Drawing 3] Drawing 3 is drawing for explaining record actuation of the record unit of drawing 2 .

[Drawing 4] Drawing 4 is drawing showing the behavior of ink [ / near the tip of the record unit of drawing 2 ].

[Drawing 5] Drawing 5 is drawing for explaining record actuation of the record unit concerning the gestalt of implementation of the 2nd of this invention.

[Drawing 6] Drawing 6 is drawing for explaining record actuation of the record unit concerning the gestalt of implementation of the 3rd of this invention.

[Drawing 7] Drawing 7 is the perspective view showing the recording head which put in order and multichannel-ized the record unit of drawing 2 .

[Drawing 8] Drawing 8 is the perspective view showing the recording head which put in order and multichannel-ized the record unit of drawing 2 .

[Drawing 9] Drawing 9 is the perspective view showing the recording head which put in order and multichannel-ized the record unit of drawing 2 .

[Drawing 10] Drawing 10 is the perspective view showing the recording head which put in order and multichannel-ized the record unit of drawing 2 .

[Drawing 11] Drawing 11 is the perspective view showing a part for the point of the record unit concerning the gestalt of implementation of the 4th of this invention.

[Drawing 12] Drawing 12 is drawing for explaining record actuation of the record unit of drawing 11 .

[Drawing 13] Drawing 13 is drawing for explaining record actuation of the record unit concerning the gestalt of implementation of the 5th of this invention.

[Drawing 14] Drawing 14 is drawing for explaining record actuation of the record unit concerning the gestalt of implementation of the 6th of this invention.

[Drawing 15] Drawing 15 is the perspective view showing a part for the point of the record unit concerning the gestalt of implementation of the 7th of this invention.

[Drawing 16] Drawing 16 is the perspective view showing the recording head which put in order and multichannel-ized the record unit of drawing 15 .

[Drawing 17] Drawing 17 is the perspective view showing the recording head which put in order and multichannel-ized the record unit of drawing 15 .

[Drawing 18] Drawing 18 is the perspective view showing the recording head which put in order and multichannel-ized the record unit of drawing 15 .

[Description of Notations]

1 -- Ink jet printer,

4 -- Platen roller,

10 -- Recording head

11 -- Ink supply pipe,  
12 -- Ink hold section,  
13 -- Ink recovery tubing,  
31 -- Record unit,  
32 -- Supporter material,  
33 -- Ink passage,  
34 -- Discharge electrode,  
34a -- Ink receptacle section,  
341 -- Opening,  
36 -- Power source,  
37 -- Ink recovery way,  
38 -- Guide member,  
52 -- Condensation electrode  
62 -- Coating  
P -- Recording paper,  
p -- Point recording [-ed ],  
E, E' -- Electric field.

---

[Translation done.]